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DEVELOPING NUMBER SENSE

The Interscholastic League Bureau

Extension Division

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The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

Sam Houston

Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

Mirabeau B. Lamar

FOREWORD

This bulletin was prepared by John W. Calhoun, Professor of Applied Mathematics in the University of Texas. It is believed that it will be helpful especially for those teachers of arithmetic who are preparing students for Interscholastic League contests in arithmetic.

The purpose of the League's Arithmetic Contest may be stated as follows:

> This contest is for the purpose of developing in those students who undertake it a "number sense" which will enable them to compute quickly and with a fair degree of accuracy simple arithmetic problems.

It is thought that conscientious attention to the suggestions made in this little bulletin and entry into the contest in the right spirit will be of service in relieving the teaching of arithmetic of some of the drudgery which we find charged against it by both pupils and teachers.

The rules for conducting the Arithmetic Contest in the County Meet are given on pages 41 to 42, inclusive, of the Interscholastic League Constitution and Rules, which is Bulletin No. 2622.

Each member-school is entitled to one free copy of this bulletin on request. Additional copies are sold for 10 cents apiece, 75 cents per dozen, or $5 per 100.

ROY BEDICHEK,
Chief, Interscholastic League Bureau,
Extension Division.

I

THE STUDY OF ARITHMETIC

In these days when so many subjects are competing for favor of students and teachers, it becomes important to be able to give a convincing answer to the question, "Why should I study this?" or "What good will I get from that?" or "What is the use of the other?" Fortunately for arithemetic this question is easy to answer. But the fact that it is so easy has caused its teachers to be less alert in its defense and less clear and concise in their statements of its merits. Home economics, manual training, modern languages, and the like, have had to fight for a place on the program, and this has developed the resourcefulness of their advocates in calling attention to their merits. Arithmetic having been long intrenched in what seems to be a safe place in the curriculum, seems in danger of losing prestige by the apathy of its advocates.

Just what is the function of arithmetic in the schools? Why should it engage a considerable amount of the time of every student who enters the public schools? What good may the student expect to get from it? What inconvenience will he suffer on account of a lack of proficiency in it? The student is entitled to answers to those questions. And they should be somewhat more specific than the statement that "A study of arithmetic will improve the mind." The average boy or girl does not feel any great urge for mental improvement. He is likely to suspect that his mind is pretty good as it is. It is not surprising that the mere prospect of mental improvement does not excite any wild enthusiasm in the breast of children from ten to thirteen years of age.

The writer has not consulted a psychologist on this matter, but he strongly suspects that some perception of numbers is among the earliest mental developments of the individual and of the race. The disposition to count comes early in the life of a child. His fingers are still in the baby state of chubbiness when they are drafted to use for counting. So fundamental a thing, then, ought easily to obtain and to hold the interest of children. And it will if properly presented.

No boy asks why learn to read. No girl asks why learn to write. No child asks why learn to walk. The necessity for being able to do these things impresses itself on the child before he is old enough to formulate the question of why. Arithmetic is almost as obvious. One must be able to count the members of his family, to count his flocks and his cattle. Children in play must keep count of some sort of score. One must count up one's age, must estimate his wealth, must know distances—all expressed as numbers. Whichever way one turns he runs foul of numbers. "Even the hairs of one's head are *numbered.*"

All people must learn to walk. People who cannot walk are helpless. They are objects of great pity. They are likely to be objects of charity, to be a burden to someone as long as they live. People who walk badly or with difficulty, whose steps are halting and uncertain, who move slowly, if at all, who are always in danger of falling, are called cripples. They are at a great disadvantage. They excite our pity and sympathy. They have a heavy handicap in their attempt to compete for a place in the world. It is only by being exceptionally talented in some other way that a cripple can compete on anything like an equality with others. Most people, cripples included, are not so gifted.

Since number is so fundamental in our lives, since so nearly all that we have to do makes some contact with numbers and computation with numbers, since the whole world of business, finance, and industry, is expressed in numbers, it is clear that an acquaintance with numbers is of prime importance. It is entitled to be compared to walking. Also, just as being able to walk competently, takes one out of the cripple class, so, being able to use numbers competently, which means accurately and with speed, takes one out of the class of number cripples.

The population of a country, its wealth, its extent, its expenditures for roads or schools, its taxes, its exports, its imports, its products, its rainfall, its temperature—in fact, almost all information is given in terms of numbers. Railroad building, canal digging, airplane navigation, baseball team rating, Ty Cobb's batting average, Charlie Chaplin's income tax, all are matters involving arithmetic. And arithmetic, to be of any use at all, *must* be accurate and *ought* to be speedy.

As arithmetic is now organized, the long difficult problems concerning the length of the head, the tail and the body of a fish, the problems that taxed the analytic ingenuity of the students of the eighties and the nineties, have been all taken over by algebra and are easily solved by means of an equation. This is as it should be. But the most important part of arithmetic remains, the art of rapid and accurate calculation. No problem in arithmetic ought to involve any serious analysis, certainly not before high school arithmetic. The method to be followed in the solution should be obvious. This enables teacher and student to concentrate on facility of calculation. A bill of goods cost $1,865 and was sold at a profit of 19%, find the selling price. Any fairly intelligent student knows as soon as he reads this problem that he must add 19% of the cost to $1,865. The analysis is so trivial that unless he notices that the profit is about one-fifth of $1,865 or $350 to $400, and the selling price in the neighborhood of $2,200, the pupil stands to get nothing at all from the problem. To multiply $1,865 by 19 hundredths, getting $345.35, and finding $1,865+$354.35 equals $2,219.35 is drudgery, but estimating it mentally in competition for speed with a fellow student is an adventure.

II

ESTIMATE ANSWER IN ADVANCE

If the average student of arithmetic should solve the problem: "A grocer bought nineteen boxes of apples at $1.25 a box and sold them at a profit of 17 per cent, how much did he gain?" and should get for his answer 83 cents, and should look for the answer in the book (as he would be sure to do) and find that the book carried 83 cents as the answer he would experience a feeling of perfect satisfaction and tell himself that when it comes to arithmetic he was there with the goods.

But if, on the other hand, he should get $3.95 and find that the book gave 83 cents as the answer, he would at once begin to backtrack and try to find where he had gone wrong. It would, perhaps, never occur to him that he might be right and the answer in the book wrong.

Now before the boy put pencil to paper he should have made an analysis of the problem about as follows:

Nineteen times $1.25 is about $24; 17 per cent is about one-sixth, hence the profit was about one-sixth of $24, or $4. His subsequent written calculations are merely made to refine on the accuracy of this mental approximation. If he had made this rough solution mentally and had found 83 cents as the answer in a book he would have known the answer was wrong—if he had been trained in a way to give him confidence in his own mental processes.

There is a great deal more importance in having a student place confidence in his results than to get them in the first place. Understanding the problem, sensing its consequences, judging its results are of vastly more importance than rules and algorithms.

Any class in arithmetic that has passed the most elementary aspects ought to be able to give mentally and without hesitation good approximations to such problems as the following:

(1) 9 per cent of $356.87.
(2) 8½ per cent of $5,643.90.
(3) 5/9 of 864.
(4) 3/8 of 1/5 of 2,641.

In estimating the first the easiest way is to note that 9 per cent is about 1/11 and that is slightly less than 1/10; 1/10 of the number is 35 or 36, so 9 per cent will be slightly less, say 32. Another way is to observe that 1 per cent is about 3½ and 9 per cent is 9 times 3½. Such an analysis will effectually prevent the very common and inexcusable error of misplacing the decimal point.

The second one of those would be solved by noticing that 8½ per cent is close to 1/12 and proceeding as in the first one. To find approximately 5/9 of 864 it is sufficient to notice that 5/9 is greater

than ½ and less than 2/3. This puts the answer between 432 and 570. In the last, note that 1/5 of 2,641 is slightly more than 500 and 3/8 of 500 is not far from 200.

Simple work like this to cultivate the sense of numbers and an instinct for the correct answer will prevent the student from accepting an absurd result simply because he thinks he has performed the requisite calculation.

In a recent college entrance examination in Advanced Arithmetic, students were asked to find at what price Liberty Bonds bearing 4¼ per cent interest should be bought in order to yield 6 per cent on the investment. The slightest thought and judgment applied to the problem beforehand would have told even a dull student that they must be bought below par—that 4¼ per cent of 100 will be 6 per cent of a smaller number than 100. Yet several students went through some "hocuspocus" and got 105 for the answer and turned it in apparently unaware of the absurdity on the face of the result.

EXERCISES

20% of 15,325
14% of 7,784.
3/8 of 16.521.
5/9 of 4,624.
1/3 of 2/5 of 3,186.
5/9 of 1/4 of 864.
15/7 of 8,421.
3 1/7×85.
3 1/7×596.

III

DEVICES FOR MAKING ESTIMATES

The importance of having some idea in advance as to what the answer to a given problem should be has just been pointed out. Here are some simple devices for estimating in advance about what a required result will be.

Let us consider multiplication. It is well known to most students that multiplication by 10, 100, 1,000, etc., merely results in giving as the product the multiplicand with one, two, three, etc., ciphers attached, e.g.

$26 \times 10 = 260.$
$351 \times 100 = 35100.$
$39 \times 1000 = 39000.$

Any student can give the results of such multiplications in his head at once without resorting to pencil or chalk.

Let us consider the result of multiplying by 5, 50, 500, etc. Since 5, 50, 500, are just half as much as 10, 100, 1000, the products, when these numbers are used, will be just half as great as in the preceding case. i.e.

$26 \times 5 =$ One-half of 260 or 130.
$351 \times 50 =$ One-half of 35100 or 17550.
$39 \times 500 =$ One-half of 39000 or 19500.

The fact to be noted is that multiplication by 5, 50, 500 can in reality be effected by dividing by 2. The method is as follows:

10×26 is 260, 5×26 is one-half of 260 or 130.

It is readily seen that multiplication by 25 can be accomplished by dividing by four, multiplication by 33 1/3 by dividing by 3, multiplication by 20 by dividing by 5, 16 2/3 by 6, 12½ by 8, etc.

Find at once 138×25. Let the student note that $138 \times 100 = 13800$; then $138 \times 25 =$ one-fourth of 13800. Call attention to the fact that one-fourth of 13000 is about 3000, then on dividing by 4 the student will write at once 3450. With a little practice he will do the whole thing in his head, merely taking one-fourth of 13800. Take 15.641×500. Call attention to the fact that 1000 times 15.641 is about 15000. One-half of 15000 is between 7000 and 8000. Dividing by two we get 78205 as the succession of figures. Since we have already noted that the result is 7000 or 8000, there is no difficulty, no question even, about placing the decimal point. The result is ob-

viously 7820.5. In like manner $31,648 \times 25 = 3164.8 \div 4 = 791.2$. The teacher can multiply such examples indefinitely.

But it may be urged that most problems do not give such handy multipliers as these. This is true, but we can easily calibrate most of those we have to these. And this is where the merits of this method are most conspicuous; e.g. $72 \times 47 = ?$ Notice that 47 is close to 50. If we had 72×50 the answer, from what we have had above, could be read off at once as 3600, but changing 47 to 50 increases it by about 1/16 of itself. Hence we ought to pull off about that amount of 72; 1/16 of 72 is about 4. Hence 72×47 is about equal to 68×50, that is 3400. Actual multiplication gives 3384. No student trained to "size up" products by looking at the factors would accept 2384 for the above result if a mistake seemed to give this answer.

Examples:

To find 87×36, use $94 \times 33\ 1/3 = 3111$.

To find 142×63, use $135 \times 66\ 2/3 = 9000$.

To find 12.84×19, use $12 \times 20 = 240$.

To find 645×17, use $650 \times 16\ 2/3 = 10900$.

Any clever teacher can adapt almost any case to some one of these, and, better still, can teach his students to do it.

EXERCISES

Give quickly approximate answers to the following problems:

126×24.
82×49.
237×34.
815×17.
256×52.
841×26.
463×21.
519×67.
844×76.
$1,256 \times 14$.
$4,928 \times 16$.

IV

COMBINE DRILL WITH THOUGHT

Too much mechanical drill, instead of being educational may well become stupefying. Drill that combines practice with thought is both useful and delightful.

It requires little drill to secure ability on the part of students to add instantly two numbers each represented by a simple digit—*e.g.* 8+7, 5+9, 6+8, etc. A little drill will enable any average student to give the answer to such exercises instantly and accurately.

When this has been accomplished attention should be called to the fact that adding numbers of two digits, the last being 0, is just as easy as adding one digit numbers—*e.g.* 8+7=15, 80+70=150, 5+9=14, 50+90=140, etc.

Children take some pride in the fact that they can add numbers of this size in their heads instead of having to write them down. And this leads me to remark that, in my judgment, most of the arithmetic sense with which children are born is siphoned out of them by the pencil route.

This brings us to the question of adding mentally numbers like 36 and 47. This can be done with perfect ease and accuracy if the teacher first learns to do it himself and gives a little thought to helping the students. To add 36 and 47, note that these things are involved, all simple, the addition of 30 and 40, and the addition of 6 and 7, and combining the results. Any child can be taught with little effort to add 30 and 40 getting 70, and 6 and 7 getting 13, and 70 and 13 getting 83. 55+38 is 50+30 and 5+8, and 80+13 gives 93.

Any teacher who has never tried this will be astonished to find after a little practice how quickly children will call out the answers to problems like 58+46, 85+39, 72+29, 88+34, etc.

When this has been mastered, advancing to numbers like 167+349 is possible with students of a little more advancement.

EXERCISES

Add quickly the following:

53+74.
81+27.
56+23.
76+32.
85+54.
86+25.
78+56.
89+34.
77+68.

41+32+24.
42+25+61.
53+25+34.
62+48+25.
44+55+66.
39+24+32.
65+35+42.
53+25+74.

(NOTE.—Teachers of arithmetic should watch the columns of the LEAGUER for suggestions concerning the preparation of students for this contest. Each student should have an individual copy of this bulletin.)

V

SKILL IN PERCENTAGE

At the very first mention of percentage, it should be made clear that 10 per cent means ten hundredths and, hence, i.e., one-tenth of something. This interpretation of percentage should never be lost sight of for a moment. The first drill on the subject should be devoted to translating various rates of percentage into simple and familiar fractions.

The pupil should use the expressions "50 per cent" and "one-half" interchangeably. They should mean the same thing without his having to stop and reflect at all. The teacher should set the example of reading problems and putting "one-fourth" instead of "25 per cent," "33 1/3 per cent" instead of one-third," etc.

A man invested $2,000 in cattle and lost 25 per cent of his money, find his loss. The student should be taught to read this just as readily: "A man invested $2,000 in cattle and lost one-fourth of his money, find his loss." If this is done, the problem can be answered mentally. But suppose the problem reads: "A man invested $2,165 in cattle and lost 25 per cent, find his loss." The student trained to see that 25 per cent equals one-fourth can give a *good approximation* to the answer in a flash and can get it exactly in a few seconds without putting pencil to paper.

When the student has been thoroughly taught that 50 per cent equals one-half, 25 per cent equals one-fourth, 20 per cent equals one-fifth, 10 per cent equals one-tenth, etc., he can then be brought to see that such rates as 35 per cent, 65 per cent, 17 per cent, 14 per cent are almost equal to one-third, two-thirds, one-sixth, and one-seventh, respectively. Hence, 35 per cent of $14,265.36 will be slightly more than one-third of it, or in the neighborhood of $5,000. This information will keep him from accepting an answer as correct that is a gross error, though obtained by what he thinks a correct set of calculations.

Stocks with a face value of $86,540 sold at 14 per cent below par. What did they bring? Fourteen per cent is about one-seventh. A glance at the face value shows that one-seventh of it is about $12,000. This subtracted from the face value leaves about $74,500. This fixes the approximate value of the answer.

Suppose the problem requires that the rate be found. The principle is the same. Goods bought for $47 sold at $56, find per cent of gain. The gain is $9. This is slightly less than one-fifth of $47. One-fifth equals 20 per cent. The gain is slightly less than 20 per cent. The pupil who thinks thus will never be in any danger of taking 1.9 per cent or 190 per cent for the answer.

It is not the intention of the writer to advocate the non-usage of the ordinary methods of solving problems in percentage. But he

strongly urges that all per cents be thought of as ordinary fractions and preliminary approximations to the result secured before the written calculation (when one is necessary) is undertaken at all. This will cause no loss of time, but, on the contrary, will result in a great saving of time, and what is vastly more important, in making the student eventually sure-footed.

EXERCISES

The student should give oral answers to problems like these very rapidly and with considerable accuracy:

9% of $8,963.	1/2 of 1% of $97,563.
2% of $659.35.	1/10 of 1% of $3,865,429.
11% of $2,256.	16 2/3% of $19.50.
12% of $1,856.	8% of $3,258.95.

Approximately what simple fraction is equal to 17%, 35%, 41%, 83%, 65%, 19%, 8%, 7%, 14%?

What per cent, approximately, is each of these fractions: 1/7, 1/8, 1/5, 1/6, 2/9, 3/7, 4/11, 1/50, 1/100, 1/16, 1/26, 4/9, 5/7?

DIRECTIONS FOR CONDUCTING THE CONTEST.

Read carefully the rules contained in Bulletin No. 2622, pp. 41–42.

The Director of Arithmetic should furnish each contestant with a copy of this Bulletin, No. 2638, after the contestants are assembled in the room and ready to begin the contest. They will be furnished free of charge from the State Office upon request. The Director of Arithmetic should, however, make a careful estimate of the number he will need. No contestant should be allowed to bring with him his individual copy of the Bulletin. After each contestant has been provided with a copy, the drawing should be made to determine the number of the problem with which the contest is to begin, see Rule 3, p. 41, Bulletin No. 2622. The contestant should be instructed *not* to copy down the problem, but simply to write down the number of the problem in parenthesis, with his answer after it in each case. For illustration, say that the contest begins with No. 832: The contestant should write the number thus: (832) and place his answer immediately after it, and (833) with the answer immediately after it, and so on. If he cannot solve a problem, he should write down the number of it in the same way, leaving space for the answer blank. This facilitates the grading.

Graders of the arithmetic papers shall be furnished with and shall observe the following instructions:

In the contest problems (except those involving merely simple addition and subtraction) answers within 5% of the correct answer will be graded 5; that is, such are considered a "solution" within the meaning of Rule 4, page 41 of the Constitution and Rules. Answers in error by more than 5% will be graded 0.

Example: Find 20% of 8625. The correct answer is 1725. Five per cent of this answer is 86. 1725+86=1811. 1725—86=1639. Any answer between 1639 and 1811 will be graded 5. Any answer less than 1639 or greater than 1811 will be graded zero.

In problems of simple addition or subtraction, the answer must be exact to be graded 5.* The method of computing the scores is fully covered in Rule 4, p. 41, Bulletin No. 2622.

CONTEST PROBLEMS

(1). A car which cost $1,200 was sold for $400. What was the per cent loss?

(2). Coal which cost $8 a ton was sold for $11 a ton. What was the per cent gain?

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*By "simple addition or subtraction" is meant problems in which plus and minus signs are used and does not include any of the statement-problems.

(3). 21+36
(4). 41+92
(5). 24×39
(6). 49×57
(7). 1/5 of 653
(8). ⅛ of 891
(9). 73+21+67
(10). 82+35+61
(11). 97—38
(12). 64—26
(13). 71—34
(14). 34×27

Approximately what per cent is each of these fractions:
(15). 3/25 (16). 1/7 (17). 5/9

Approximate what simple fraction is equal to:
(18). 2% (19). 81% (20). 12%

(21). A man bought goods for $3.82, sold them, and lost 100%. What did he get for the goods?

(22). If a farmer feeds his stock ¼ bushel of corn daily, how long will 8½ bushels last?

(23). 9% of 2500
(24). 12% of $480
(25). 57—28
(26). 87—29
(27). 94—19
(28). 17×49
(29). 8% of 640
(30). 81% of $250
(31). 52×67
(32). 69×26
(33). 12×38
(34). 2/5 of 643

(35). Sugar which cost 8 cents a pound was sold for 11 cents a pound. What was the per cent gain?

(36). If 7% of a farm is 25 acres, how many acres are there in the whole farm?

(37). 47+36
(38). 26+44
(39). 14+18+16
(40). 13×93
(41). 21×92
(42). 97×25
(43). 1/8 of 961
(44). 39% of 325
(45). 29+42
(46). 17+29
(47). 23+7+27
(48). 15×74
(49). 86×11
(50). 26×67
(51). 1/7 of 856
(52). 12½% of 888

Approximately what simple fraction is equal to:
(53). 6% (54). 20% (55). 87%

Approximately what per cent is each of the following fractions:
(56). 2/5 (57). 5/18 (58). 13/40

(59). 62—28
(60). 87—51
(61). 64—27
(62). 6% of $33.50
(63). 2/7 of 533
(64). 74—38
(65). 102—91
(66). 61—49
(67). 3/8 of 649
(68). 9% of $7488

(69). A car costing $650 was sold at 10% gain. What was the amount of gain?

(70). A car costing $650 was sold, and the amount of gain was $18.50. What was the rate of gain?

(71). 14×64
(72). 19×81
(73). 20×59
(74). 47—23
(75). 21+19
(76). 62+31
(77). 47—23
(78). 46×16
(79). 33×86
(80). 66×65
(81). 94—57
(82). 75+83
(83). 48+26
(84). 94—57
(85). 67% of $715
(86). 9% of $7488
(87). ¾ of $85.70
(88). ⅝ of 649
(89). 50×453
(90). 15+17+12
(91). 14% of $490
(92). 17% of $74.88
(93). 4/11 of $243
(94). 1/12 of 6546
(95). 75×84
(96). 16+14+28

Approximately what per cent is each of these fractions:
(97). ⅛ (98). 1/26 (99). 1/16

Approximately what simple fraction is equal to:
(100). 3% (101). 67% (102). 9%

(103). 50% of $7.48
(104). 10% of $937
(105). 49% of $8532
(106). 24×21
(107). 17×83
(108). 26×55
(109). 27+35+16
(110). 18+24+55
(111). 74+16
(112). 47—23
(113). 11% of $748
(114). 25% of $9370
(115). 74% of $579
(116). 49×34
(117). 25×99
(118) 12×78
(119). 25+37+91
(120). 24+18+26
(121). 23+48
(122). 94—57

(123). A man's expenses are $28 a week, which is 70% of his salary. How much does he earn in a week?

(124). In a certain school 96 students study arithmetic. Forty-eight per cent of the students study arithmetic. How many students are there in the school?

(125). A school enrolls 230 boys, which is 115% of the number of girls enrolled. How many students are there in the school?

(126). 47—23
(127). 26—18
(128). 91—37
(129). 13×49
(130). 36×21
(131). 92×14
(132) 3/10 of 8741
(133). 2/11 of 3333
(134). 8% of $3460
(135). 14+37+21
(136). 73+94
(137). 30+47
(138). 94—57
(139). 54—39
(140). 46—28
(141). 15×58
(142). 43×67
(143). 16×80
(144). 5/9 of 6439
(145). 33% of $84
(146). 15% of $585
(147). 42+63+91
(148). 64+37
(149). 18+38

What per cent, approximately, is each of these fractions:
(150). 4/11 (151). 3/20 (152). 3/5

What simple fraction is approximately equal to:
(153). 7% (154). 41% (155). 11%

(156). 75×77
(157). 19×987
(158). 11×19
(159). 71+62
(160). 64+24
(161). 76—57
(162). 1/3 of ⅝ of 675
(163). 87% of 214
(164). 11×148
(165). 33×791
(166). 13×17
(167). 43+17
(168). 53+27
(169). 61—42
(170). 1/5 of $2491
(171). 65% of 84

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(172).	----------	16⅔%	$ 12.60
(173).	----------	15%	$185.00
(174).	$2596	14%	---- --------

(175). 22+44+87
(176). 72+43
(177). 17+98
(178). 4/9 of 8971
(179). 2/7 of 1591
(180). 21% of 865
(181). 32% of 891
(182). 32—19
(183). 44—28
(184). 97—42
(185). 66×45
(186). 634×50
(187). 12×23
(188). 17×12
(189). 17+18+76
(190). 64+19
(191) 38+33
(192). 2/9 of 1863
(193). 2/5 of 5630
(194). 24% of 725
(195). 17% of 536
(196). 47—33
(197). 72—18
(198). 49—32
(199). 11×21
(200). 13×21
(201). 30×184
(202). 11×15

What per cent, approximately, is each of these fractions:
(203). 3/7 (204). 5/12 (205). 4/5

Approximately what simple fraction is equal to:
(206). 4% (207). 65% (208). 8%

(209). 24+96+48
(210). 17×25
(211). 70—43
(212). ⅝ of 5164
(213). 21+47+26
(214). 14×22
(215). 49—35
(216). 2/11 of 3521

(217). A man is 60 years old, and his age is 110 per cent of his wife's age. How old is his wife?

(218). 40% of a certain ship's cargo is 250 barrels. How many barrels are there in the whole cargo?

(219). 80% of the population of a certain city is 64,000. What is the population?

(220). 10×15
(221). 11×25
(222). 13×15
(223). 18×19
(224). 4/25 of $371.80
(225). 67% of $3.72
(226). 17% of 960
(227). 95—18
(228). 42—28
(229). 92+34
(230). 36+15+29
(231). 10×23
(232). ⅞ of $37.18
(233). 67% of 842
(234). 3/50 of $891
(235). 93—84
(236). 75—37
(237). 48+29
(238). 19+54+21
(239). 14×25

(240). Jack is 15 years old, and his age is 30% of his father's age. How old is his father?

(241). 18×21
(242). 36× 87
(243). 47—19
(244). 79—36
(245). 4/9 of 1897
(246). 4/11 of 3591
(247). 88% of 763
(248). 14% of 776
(249). 91+25+45
(250). 56+73
(251). 12×14
(252). 21×94
(253). 54—39
(254). 54—27
(255). 4/7 of 1584
(256). 4/5 of 5521
(257). 62½% of 80
(258). 23% of 659
(259). 27+73+21
(260). 72+29

What per cent, approximately, is each of these fractions:
(261). 1/5 (262). 4/9 (263). 5/16

(264). ½ of 25% of $3260
(265). 34% of $9217
(266). 24+72
(267). 18×10
(268). 39×81
(269). 59—39
(270). ⅓ of 60% of 687
(271). 5% of $2589
(272). 63+92
(273). 13×22
(274). 55×80
(275). 47—18

Approximately what simple fraction is equal to:
(276). 79% (277). 35% (278).10%

(279). 15 is what per cent of 60?

(280). A man receives $1650 a year, and his expenses are 87½% of his income. How much has he left?

(281). 62+17+27
(282). 95+81
(283). 12×13
(284). 98—84
(285). 34% of $92.17
(286). ⅔ of $24.91
(287). 43+52+55
(288). 57+59
(289). 13×23
(290). 89—33
(291). 5% of $2580
(292). 1/9 of $249

What per cent, approximately, is each of these fractions:
(293). 3/5 (294). 11/31 (295). 33/65

(296). The number of pupils in daily attendance in a certain school is 420, which is 90% of the number enrolled. How many pupils are enrolled?

(297). 576×66
(298). 20×24
(299). 12½% of $51.25
(300). 2/5 of 3987
(301). 6/25 of $398
(302). 36+16+44
(303). 85+26
(304). 54—37
(305). 79—53
(306). 319×83
(307). 26×15
(308). 8⅓% of $6.25
(309) ¼ of 6402
(310) ⅔ of $640
(311). 24+87+29
(312). 87+66
(313). 53—34
(314). 92—46

(315). A horse was sold for $12.60 profit, which was 16⅔% of the cost of the horse. What did the horse cost?

Fill in the blank in each of the following problems with the right figures:

	Cost	Rate of gain	Amount of gain
(316).	.....	15%	$185
(317).	$2596	14%	.....
(318).	$2596	.....	$350

(319). ⅜ of $4591
(320). ½ of 1498
(321). 79% of 843
(322). 14+52+43
(323). 58+94
(324). 86×125
(325): 15×22
(326). 29—12
(327). 62—14

(328). 4/25 of 8762
(329). 2/7 of $1705
(330). 41% of 7782
(331). 71+53+31
(332). 61+37
(333). 74×251
(334). 17×19
(335). 65—21
(336). 83—75

Approximately what simple fraction is equal to:

(337). 83% (338). 29% (339). 5%

(340). 50+94
(341). 17+36+20
(342). 98+45
(343). 76×335
(344). 17×24
(345). 72—49
(346). 38—23
(347). 6/7 of $9126
(348). 5/9 of 7681

(349). 85+42
(350). 64+35+52
(351). 71+28
(352). 48×375
(353). 16×21
(354). 41—17
(355). 74—36
(356). ⅞ of 8452
(357). 3/11 of 1376

(358). Lumber which cost $63 was sold for $84. What was the per cent gain?

(359). A merchant made 11% profit on some goods which cost him $536. How much did he get for the goods?

(360). 5/16 of $5528
(361). 1/12 of 572
(362). 12% of $375
(363). 36+24
(364). 15+87
(365). 52×73
(366). 18×24
(367). 91—27
(368). 92—67

(369). 1/14 of $795
(370). 2% of $37.24
(371). 95% of $792
(372). 45+16
(373). 46+28
(374). 26×81
(375). 15×17
(376). 31—17
(377). 48—37

Approximately what per cent is each of these fractions:

(378). ⅞ (379). 4/25 (380). ⅔

(381). 71+21+19
(382). 32+46
(383). 1/7 of $8570
(384). 6% of 7920
(385). 91—23
(386). 75—19
(387). 15×12
(388). 419×380

(389). 41+29+17
(390). 76+94
(391). 17% of $188
(392). 49% of 3974
(393). 64—29
(394). 49—27
(395). 28×17
(396). 63×16⅔

(397). Find the cost of ⅛ of a sack of flour, if a sack of flour costs $6 24.

(398.) Mary is twice as old as John, who is ¼ as old as their father. If the father is 40 years old, how old is Mary?

(399). 25×371
(400). 85×12½
(401). 88—23
(402). 4% of $1096
(403). 4/11 of $2190
(404). 57+24
(405). 74×80
(406). 88×41
(407). 98—36
(408). 8% of $657
(409). 1/50 of $420
(410). 26+43
(411). 72—13
(412). 59—19
(413). 26×30
(414). 21×17
(415). 52+36
(416). 31+47
(417). 10% of $4895
(418). 52% of 869
(419). 6/25 of 936
(420). 5/7 of 261
(421). 92—45
(422. 97—36
(423). 11×71
(424). 18×22
(425). 35+27
(426). 55+30
(427). 20% of $1208
(428). 18% of 666
(429). 1/26 of 782
(430). ¾ of 263

What per cent, approximately, is each of these fractions:
(431). 1/6 (432). 1/9 (433). 7/20

Approximately what simple fraction is equal to:
(434). 25% (435). 74% (436). 49%

(437). 12 is what per cent of 36?

(438). A man travels two miles in 9 minutes. At that rate, how many miles would he travel in one hour?

(439). 75% of $432
(440). 23% of $43.20
(441). 1/7 of $36.51
(442). 3/7 of $3.65
(443). 64—43
(444). 50—21
(445). 17×84
(446). 13×54
(447). 42+83+92
(448). 35+29
(449). 83% of $961
(450). 12½% of $96.10
(451). 2/7 of $365.10
(452). 5/7 of $36.51
(453). 96—37
(454). 86—63
(455). 26×11
(456). 15×94
(457). 63+11+21
(458). 19+71

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(459).	$ 65.41	11%	-------
(460).	-------	12%	$ 63
(461).	---------	35%	$740

(462). 87+64
(463). 16+11
(464). 12×25
(465). 561×540
(466). 37—19
(467). 56—23
(468). 53—41
(469). 33% of $5746
(470). 3/5 of 5195
(471). 3/50 of 6420
(472). 29+17
(473). 84+42
(474). 13×14
(475). 835×19
(476). 88—32
(477). 59—24
(478). 56—25
(479). 50% of $9875
(480). 4/5 of 176
(481). 5/6 of 185

Express as percents:
(482). 1/10 (483). 3/8 (484). 1/14

Express as simple fractions:
(485). 14% (486). 33% (487). 17%

(488). A house which cost $5000 was sold for $6250. What was was the per cent gain?

(489). A farm which cost $3000 was sold, and the profit was $600. What was the per cent profit?

(490). 76×253
(491). 26×12
(492). 37+23
(493). 62+31
(494). 29% of $590
(495). 2/3 of 739
(496). 85×33⅓
(497). 16×55
(498). 24+17
(499). 95+21
(500). 81% of $895
(501). 4/7 of 625

(502). 12 is what per cent of 84?

(503). 84—45
(504). 59—38
(505). 66—24
(506). 5/8 of 520
(507). 7/9 of 3186
(508). 22+76
(509). 65+15
(510). 46+92+25
(511). 57—46
(512). 67—43
(513). 64—38
(514). 3/9 of 7632
(515). 3/16 of 273
(516). 93+43
(517). 47+26
(518). 13+71+54

(519). Cotton which cost 24 cents a pound was sold for 27 cents a pound. What was the per cent profit?

(520). A ship which cost $13,500 was sold, and the loss was 17%. What was the amount of the loss?

(521). 92+38
(522). 29+48
(523). 98×125
(524). 12×16
(525). 57—45
(526). 56—48
(527). 85% of 845
(528). 39% of 925
(529). 3/20 of 648
(530). 75+69
(531). 21+77
(532). 60×193
(533). 11×24
(534). 69—47
(535). 71—53
(536). 75% of 6946
(537). 52% of 587
(538). 1/33 of 3527

(539). 13 is what per cent of 52?

What per cent, approximately, is each of these fractions?
(540). 3/50 (541). 5/6 (542). 1/3

(543). How many square feet are there in the floor of a room 24 feet by 73 feet?

(544). What is the per cent of gain on potatoes which cost 3½ cents a pound, and were sold for 5 cents a pound?

(545). 13×19
(546). 850×75
(547). 99—42
(548). 92—76
(549). 87½% of $278
(550). 1/7 of 416
(551). 1/9 of 741
(552). 45+46+32
(553). 86+82
(554). 12×24
(555). 16×19
(556). 61—46
(557). 86—38
(558). 88% of $139
(559). 1/5 of 4311
(560). 3/7 of 624
(561). 23+91+75
(562). 19+46

Approximately what simple fraction is equal to:
(563). 87% (564). 49% (565). %28

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(566).	.....	42%	$126.30
(567).	$846	.....	$ 38.75

(568). 52+64
(569). 58+36
(570). 125% of $95
(571). 5/12 of 464
(572). 3% of 576
(573). 92—78
(574). 77—63
(575). 14×18
(576). 24×59
(577). 42+27
(578). 24+67
(579). 120% of $10.50.
(580). 3/20 of 2915
(581). 67% of 925
(582). 76—58
(583). 78—57
(584). 17×20
(585). 49×64

Approximately what per cent is each of these fractions?
(586). 5/4 (587). 4/3 (588). 4/32

(589). A house was sold for $7000, and the contractor made $900 by the sale. How much did the house cost him?

(590). 50×17
(591). 16×82
(592). 93—61
(593). 89—62
(594). 16⅔% of 1256
(595). 72% of 835
(596). 1/5 of $3.56
(597). 1/9 of $356
(598). 92+32+29
(599). 53+45
(600). 19×25
(601). 17×37
(602). 98—79
(603). 64—27
(604). 8⅓% of 954
(605). 85% of 936
(606). 2/5 of $35
(607). 1/7 of 35c
(608). 16+58+64
(609). 99+69

Approximately what simple fractions is equal to:
(610). 11% (611). 14% (612.) 74%

(613). A farmer plants 65% of his farm in cotton. If he has 325 acres of cotton, how many acres are there in his whole farm?

(614). 23+47
(615). 29+71
(616). 133% of $450
(617). 72% of 270
(618). 7/20 of $2750
(619). 4/25 of 814
(620). 61—55
(621). 64—25
(622). 16×24
(623). 21×844
(624). 76+49
(625). 22+84
(626). 167% of $60
(627). 5% of 338
(628). ⅜ of 273
(629). ½ of 4811
(630). 82—66
(631). 96—55
(632). 15×19
(633). 67×85

(634). A stock of damaged goods sold for 15% less than the cost, and the merchant thereby lost $200. How much did the goods cost the merchant?

(635). 96×17
(636). 14×19
(637). 83—68
(638). 69—47
(639). 4/25 of $371.80
(640). ⅞ of $37.18
(641). 5% of $3718
(642). 25% of $3.72
(643). 64+42+83
(644). 92+45
(645). 18×23
(646). 21×32
(647). 38—22
(648). 75—24
(649). 1/16 of $645
(650). ⅓ of ¾ of $80
(651). 5/7 of $247
(652). 2/9 of $24.70
(653). 48+31+62
(654). 65+76

What per cent, approximately, is each of these fractions:
(655). ⅝ (656). 6/7 (657). 5/6

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(658).	$ 931	.....	$ 37.50
(659).	$1875	21%	.....

(660). 29+45
(661). 54+82
(662). 79% of $64.50
(663). 3% of $24.63
(664). 1/7 of 476
(665). 1/9 of 846
(666). 59—43
(667). 46—38
(668). 33×42
(669). 49×815
(670). 51+47
(671). 26+79
(672). 10% of 60c
(673). 41% of $198
(674). 1/5 of 942
(675). 3/7 of 745
(676). 71—24
(677). 78—22
(678). 17×66
(679). 26×52

(680). A man with $24 spent ¼ of what he had for a pair of shoes. How much money did he have left?

(681). 125×43
(682). 120×84
(683). 51—23
(684). 78—14
(685). 66⅔% of $93
(686). 6¼% of $863
(687). 4/11 of 592
(688). 28+13
(689). 87+84+24
(690). 23+64
(691). 33×180
(692). 75×348
(693). 89—36
(694). 84—19
(695). 87½% of $652
(696). 11% of 594
(697). 1/50 of 345
(698). 91+68
(699). 95+25+27
(700). 54+21

Express as a simple fraction:
(701). 18% (702). 11% (703). 39%

(704). A merchant bought cloth at 80c a yard, and sold it at 25% profit. What was the selling price?

(705). 42+75
(706). 26+24
(707). 6/25 of 678
(708). 5/7 of 104
(709). 14% of $87.60
(710). 74% of $8.76
(711). 63—24
(712). 44—28
(713). 17×18
(714). 34×48
(715). 25+47
(716). 27+91
(717). 1/26 of 901
(718). ¾ of 156
(719). 35% of $709
(720). 83% of $7.09
(721). 98—57
(722). 87—39
(723). 19×21
(724). 96×54

(725). Shoes, costing $7 a pair, were sold at a loss of 21% What was the selling price?

(726). 17×37
(727). 98×250
(728). 96—57
(729). 32—26
(730). 60% of $500
(731). 95% of 415
(732). ⅛ of $45.63
(733). ⅝ of $4.56
(734). 28+56
(735). 82+65
(736). 16×49
(737). 12×68
(738). 94—39
(739). 75—18
(740). 70% of $600
(741). 41% of 756
(742). ⅜ of $456.30
(743). ⅞ of $4563
(744). 19+72
(745). 15+75

What per cent. approximately, is each of these fractions:
(746). 5/17 (747). 8/21 (748). 45/83

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(749).	$2563	66%	
(750).	$8429	------	$1204

(751). 19+28+39
(752). 91+42
(753.) 1/9 of $86.51
(754). 3/10 of $869
(755). 17% of $15.34
(756). 75% of $36.18
(757). 93—68
(758). 36—23
(759). 124×89
(760). 24×180
(761). 64+42+17
(762). 48+72
(763). 2/9 of $8 65
(764). 4/10 of $86.90
(765). 51% of $93.30
(766). 72% of $6.25
(767). 91—23
(768). 34—19
(769). 249×63
(770). 19×85

(771). At what price must goods costing $6 be sold to gain 16⅔%

(772). 865×67
(773). 32×73
(774). 93—39
(775). 87—75
(776). 3/16 of $48.70
(777). 1/33 of $34.80
(778). 7% of $87.90
(779). 11% of $428
(780). 21+47+91
(781). 19+17
(782). 726×21
(783). 49×371
(784). 68—24
(785). 71—36
(786). 3/20 of $905
(787). 5/12 of $487
(788). 9% of $56.10
(789). 25% of $7628
(790). 72+75+17
(791). 84+28

Approximately what simple fraction is equal to:
(792). 50% (793). 80% (794.) 4%

(795). A merchant sold velvet at a profit of $2 a yard and gained 20%. How much did the velvet cost?

(796). 25+17
(797). 42+37
(798). 80% of $300
(799). 74% of $836
(800). 3/20 of $959
(801). 5/6 of 287
(802). 79—42
(803). 81—26
(804). 375×14
(805). 12½×864
(806). 92+54
(807). 61+39
(808). 90% of $800
(809). 65% of $767
(810). 7/20 of $371
(811). ⅔ of $47.90
(812). 79—62
(813). 86—65
(814). 963×17
(815). 95×11

(816). A dealer sold a pair of boots for $6, and thereby lost 25% How much did the boots cost the dealer?

(817). 39×61
(818). 76×145
(819). 72—13
(820). 75—28
(821). 1/10 of 72,636
(822). 7/10 of 1954
(823). 66% of 586
(824). 41% of 719
(825). 29+37+62
(826). 37+56
(827). 48×83
(828). 24×249
(829). 67—45
(830). 84—52
(831). 3/10 of 1535
(832). 3/25 of 216
(833). 5% of 5679
(834). 83% of 490
(835). 42+26+28
(836). 52+38

What per cent, approximately, is each of these fractions:
(837). 9/16 (838). 15/47 (839).16/33

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(840).	$3625	-------	$310.40
(841).	.....	12½%	$639

(842). 87+23
(843). 79+85
(844). 4/9 of $865.10
(845). 5/9 of $8651
(846). 82% of $120.50
(847). 90% of $18.39
(848). 90—67
(849). 53—36
(850). 69×32
(851). 216×24
(852). 17+16
(853). 37+21
(854). 3/11 of $634.90
(855). 7/10 of $8.69
(856). 67% of $9.30
(857). 37% of $12.86
(858). 57—48
(859). 94—25
(860). 841×663
(861). 189×33

(862). Wheat which cost $1.25 a bushel was sold for $1.20. What was the per cent loss?

(863). 82+48+31
(864). 45+21
(865). ⅛ of 361
(866). 2/9 of 879
(867). 7% of 658
(868). 14% of 260
(869). 81—64
(870). 24—17
(871). 21×78
(872). 51×351
(873). 17+23+48
(874). 67+23
(875). 1/6 of 444
(876). 1/100 of 29,764
(877). 9% of 723
(878). 35% of 427
(879. 51—39
(880). 79—62
(881). 19×442
(882). 79×125

Approximately what simple fractions is equal to:
(883). 74% (884). 83% (885). 79%

(886). A bale of cotton costing $675 was sold at 15% profit. What was the amount of profit?

(887). 81+26
(888). 27+95
(889). 17% of 223
(890). 83% of 2323
(891). 1/10 of 7.7
(892). 4/5 of 77
(893). 74—18
(894). 62—17
(895). 87×93
(896). 376×253
(897). 51+62
(898). 47+35
(899). 25% of 817
(900). 87% of 937
(901). 3/10 of 292
(902). 2/5 of 29
(903). 56—34
(904). 74—38
(905). 88×127
(906). 289×125

(907). A grocer sold butter at 40c a pound and gained 25%. How much did the butter cost him?

(908). 75+24+56
(909). 23+17
(910). 7/10 of 2855
(911). ⅛ of 5488
(912). 6% of 394
(913). 12% of 6904
(914). 55—43
(915). 42—36
(916). 436×49
(917). 21×72
(918). 65+52+28
(919). 52+73
(920). 3/25 of 269
(921). 1/6 of 2635
(922). 8% of 792
(923). 20% of 9094
(924). 58—39
(925). 72—17
(926). 249×16⅔
(927). 25×340

What per cent, approximately, is each of these fractions:
(928). 19/24 (929). 3/26 (930). 5/7

Fill in the blank in each of the following with the right figures:

	Cost	Rate of gain	Amount of gain
(931).	$3000	-------	$ 30
(932).	$3000	14%	-------

(933). 18+92
(934). 82+49+29
(935). 4% of $645
(936). 33% of $5717
(937). 4/7 of $8.20
(938). 3/9 of $267
(939). 57—53
(940). 95—72
(941). 125×76
(942). 24×314
(943). 21+36
(944). 87+43+45
(945). 10% of $34,576
(946). 50% of $369
(947). ⅝ of $9908
(948). 7/9 of $593
(949). 64—42
(950). 82—68
(951). 17×356
(952). 567×67

(953). A baseball glove cost $1.80, and was sold for $2.10. What was the per cent gain?

(954). 54+17+36
(955). 17+25
(956). 5/11 of $63.49
(957). 7/11 of $6.35
(958). 120% of $2.68
(959). 8% of 248
(960). 77—48
(961). 56—24
(962). 12.5×81
(963). 99×53
(964). 76+54+90
(965). 17+16
(966). 9/11 of 6349
(967). 3/7 of 826
(968). 110% of $34.10
(969). 87% of 6.7
(970). 84—19
(971). 46—39
(972). 576×33
(973). 84×91

What simple fraction is approximately equal to:
(974). 3% (975). 17% (976). 74%

(977). $85,000 worth of bonds were sold at 12½% loss. What was the selling price?

(978). 42+87+31
(979). 92+11
(980). 2/7 of 184
(981). ⅞ of 2786
(982). 41% of $27.86
(983). 79% of 629
(984). 89—72
(985). 72—46
(986). 51×413
(987). 36×17
(988). 48+52+67
(989). 13+42
(990). 6/7 of 394
(991). 5/9 of 596
(992). 81% of 725
(993). 49% of 1943
(994). 94—47
(995). 74—32
(996). 83×120
(997). 250×89

(998). A watch costing $80 was sold at a loss of 17% What was the selling price?

(999). 51+47+52
(1000). 13+91
(1001). 3/11 of 2786
(1002). 1/14 of 1560
(1003). 29% of 563
(1004). 88% of 144
(1005). 46—29
(1006). 23—14
(1007). 25×577
(1008). 38×85
(1009). 31+23+24
(1010). 27+14
(1011). 5/16 of 595
(1012). ½ of 4530
(1013). 87½% of 862
(1014). 95% of 247
(1015). 69—47
(1016). 62—49
(1017). 692×20
(1018). 101×86

What per cent. approximately, is equal to:
(1019). 3/7 (1020). 16/25 (1021). 4/19